Science Education Research Seminar

Science education is a key learning area within the Maltese National Curriculum. The rapid changes in science education request the necessity of on-going programme of professional development to update science teachers with innovative developments and research.

The Directorate for Quality and Standards in Education in collaboration with the Department of Maths, Science and Technical Education at the Faculty of Education, University of Malta, has recently organized a seminar to disseminate the research findings of local researchers in the area of science education. The participants were welcomed by Prof. Grace Grima and Prof. Frank Ventura. During the seminar Prof. Judith Bennett from the University of York delivered a keynote presentation related to context-based approaches to teaching science.

Following Prof. Bennett’s contribution, six M.Ed graduates presented their studies in relation to the latest developments in science education. The event partly sponsored by MCST, was attended by a good number science educators.

Dr Nicholas Sammut (CEO MCST) delivered a brief speech in connection with the National Interactive Centre project.

Winners of the NSTF Science Week 2011

The annual Science Week organised by the National Student Travel Foundation at Villa Bighi is now an established occurrence in the calendar of events related to Science education. Judges had a very challenging task to select the winning projects but eventually came up with the following order of merit:

1st Prize: St Thomas More College GJL Zejtun
2nd Prize: St Theresa College GJL Mriehel
3rd Prize: St Benedict College BSS Kirkop & San Andrea Senior School, Mgarr

Congratulations to all participating schools, teachers and students at: St Thomas More College GSS, Tarxien; Stella Maris College, Gzira; St Aloysius College, B’Kara; St Joseph School, Sliema; San Gorg Preca College BJL, Hamrun, St Clare’s College GJL, Pembroke; St Edwards College, Vittoriosa; Archbishop Seminary, Tal-Virtu; De La Salle College, Vittoriosa.
Ask most chemists what got them hooked on chemistry and the odds are that is was setting fire to something, causing colour changes or seeing some practical work done in front of them at a young age. The power of practical chemistry to stimulate young minds, to inspire students to want to learn further or to reinvigorate those already studying the subject should not be ignored. The sights, smells, surprises, peer discussion and excitement that this sort of education leads to reinforce teaching and learning as well as being important in its own right.

Practical work falls into two categories; demonstration and hands-on. Both have great value in chemical education. Demonstration work is more common in situations where the activity is too dangerous for the students to perform themselves, the equipment needed is limited for whatever reason or there is limited time (class practicals always take longer than demonstrations). Demonstration also gives the teacher the opportunity to stress the important science points the experiment raises. It is also good for students to see a practicing scientist correctly handling apparatus and chemicals with all the correct technique, due care for health and safety and being confident in its use.

Reasons for doing practical work are various. This can be to reinforce theoretical concepts, to form a basis on which theoretical concepts are developed, to learn or practice measurement skills, to develop the skills involved in practical investigation such as variable identification, error analysis, producing real data for mathematical manipulation and for problem solving to name just a few. Practical work can be to raise aspirations and to be simply for fun. One could even discuss the need to do ‘hands-on’ to appeal to the kinaesthetic learners.

As this International Year of Chemistry it is worth considering putting even more practical work into the chemistry lessons. I offer two of my favourites, one a demonstration and one suitable for a fun class practical.

**The Whoosh Bottle Demonstration**

Perhaps you saw this performed when I was lucky enough to be in Malta delivering the lecture demonstration ‘A Pollutant’s Tale’. The experiment involves the igniting methanol or propan-2-ol vapour in a dry 18-25 litre plastic water bottle and spectacularly demonstrates complete combustion. The whoosh bottle experimental details can be found at:


*“If students’ understandings are to be changed towards those of accepted science, then intervention and negotiation with an authority, usually a teacher, is essential.”*  
Rosalind Driver (1995)

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Q & A — M.ED. (Science Education)
Enhancing research and practice in Science Education

The Department of Mathematics, Science and Technical Education within the Faculty of Education, University of Malta, will once again offer practicing science teachers the possibility to enrol in the M.ED. (Science Education) course. Through this article, Dr Deborah Chetcuti, Head of the department of Maths, Science and Technical Education and senior lecturer in Science education has gently accepted to answer some of our questions related to this postgraduate course.

In 2006 your department has for the first time offered M.ED. (Science Education). What encouraged the staff at DMSTE to engage in this endeavour and eventually start this course?

The M.Ed.(Science Education) was started as a response to a number of requests to start an M.Ed.(Science Education) by a number of science teachers. The community of science teachers had a large cohort of B.Ed.(Hons.) graduates who had been teaching for some time and wanted to further their studies and their professional development. The Science Team at University therefore decided that the time was right to launch the M.Ed. (Science Education).

What are the aims of the M.ED. (Science Education)?

The main aim is for science teachers to develop their skills and reflect critically and constructively on their practical experiences in schools. These practical experiences are then linked to both research as well as to the theoretical, social and cultural implications of science education.

Can you please give us a description of the content prospective students will have to cover along the course? What will the study units entail?

The M.Ed. (Science Education) includes a number of core study units in Research Methods.

The course then includes four study units in the area of Science Education. Three of these study units are compulsory and one study unit is an elective.

Students will also be asked to complete a dissertation based on original research carried out in a specific area of Science Education.

What are the entry requirements that have to be satisfied in order to be accepted for this course?

Prospective candidates for the M.Ed.(Science Education) will have to satisfy the general entry requirements to the M.Ed. Course. These can be accessed on the University of Malta website.

The selection of candidates will be based on:
- Qualifications
  - Degree and classification
- Teaching Experience
  - Years of teaching science
- Research and Professional Development
  - Dissertation, seminars and conferences attended
  - Professional Development Portfolio
  - Evidence and reflection
- Interview
  - Clear intentions for professional development

How can anyone achieve more information about this course?

More information about the course can be obtained on the Faculty of Education site on the University of Malta webpage.
The history of chemistry is based in part on the discovery and study of the chemical elements. Some of the elements were known to ancient man, but most of them were discovered by alchemists and chemists. In fact, new elements are still being discovered today.

**Early Discoveries in Chemistry**

**Joseph Priestley (1733-1804)**

The great men of science of today stand on the shoulders of giants. Joseph Priestley was one such intellectual "giant" whose works laid the foundation of Chemistry. Joseph Priestley was born at Fieldhead, in the parish of Birstal, not far from Leeds, in the northern English county of Yorkshire. Joseph Priestley was a friend of Benjamin Franklin, who like Franklin was experimenting with electricity before turning his full attention to chemistry.

Priestley's skill in the use of laboratory apparatus proved valuable in his study of the chemical properties of gases. He was the first chemist to prove that oxygen was essential to combustion and along with Swede Carl Scheele is credited with the discovery of oxygen by isolating oxygen in its gaseous state. Priestley named the gas "dephlogisticated air", later renamed, oxygen by Antoine Lavoisier. He also discovered hydrochloric acid, nitrous oxide (laughing gas), carbon monoxide, and sulfur dioxide.

In 1767, Joseph Priestley invented the first drinkable manmade glass of carbonated water (soda water). He published a paper called *Directions for Impregnating Water with Fixed Air* (1772), which explained how to make soda water.

**IT’S A FACT**

April 15, 1770, Joseph Priestley recorded his discovery of Indian gum's ability to rub out or erase lead pencil marks. He wrote, "I have seen a substance excellently adapted to the purpose of wiping from paper the mark of black lead pencil." These were the first erasers which Priestley called a "rubber".
The English teacher, chemist, and physicist, John Dalton was born into a modest Quaker family in Cumberland, England. The first paper he delivered before the society was on colour blindness, which afflicted him and is sometimes still called “Daltonism.”

A self-taught experimenter, he devised simple but effective apparatuses for his well-planned tests. Although authors have emphasized the crudeness of his results, much of his data is remarkably accurate. Throughout his life Dalton was interested in the Earth’s atmosphere, and he recorded more than 200,000 atmospheric observations in his notebooks. These observations led Dalton to study gases, and from the results of his experiments he was able to formulate his atomic theory.

He realised that each element is made from atoms of a certain size, and compounds form when atoms of one element join with atoms of another.

**IT’S A FACT**

Dalton worked out the weight of each atom by weights of the elements in different samples of different compounds.

**Dimitri Mendeleev (1834-1907)**

Mendeléev was born in Tobolsk, Russia. In the early 1800’s, scientists discovered even more chemical elements so that by 1860 more than 60 were known. Yet, there seemed no order to their properties.

Russian chemist, Dimitri Meneléev arranged them in order of the weight of their atoms, starting with the lightest: hydrogen.

He then saw that elements with similar properties could be arranged in eight neat vertical groups. This arrangement, later called the Periodic Table, is now central to our understanding of the elements.

Mendeléev was able to successfully predict the discovery of as yet undiscovered elements that would fit in according to his law, as demonstrated by the specific gaps he left in his table.

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The following article was researched and compiled by Ms. Charlotte Saliba Camilleri. Ms. Saliba Camilleri is a Head of Department (Physics) at St.Benedict’s College Girls Junior Lyceum St.Lucia.
The aim of this study was to investigate whether proficiency in English language acts as a barrier to Maltese students when they learn physics and sit for the Secondary Education Certificate (SEC) physics examination.

A set of four questions taken from SEC physics past examination papers were chosen and a test was devised. The test included three versions: the questions in the first version of the test were left unaltered; the bilingual version consisted of a Maltese and an English version, and the modified version, for which simpler English was used. These tests were administered to 380 students. A stratified sample of students, boys and girls, from State, Church and Independent schools was used. A questionnaire to investigate students’ views regarding the preferred language of physics lessons and examinations was also included with these tests. A cloze test and readability tests were also conducted with a number of students to find out more about the students’ reading comprehension. It was found that the students had reached the ‘instruction level’. Thus they need guidance from their teacher to help them understand the text.

From the questionnaire it was found that most students (82.8%) in the sample speak Maltese or mostly Maltese at home. Thus one can say that the majority of Maltese students use their mother tongue at home. Most teachers (83.3%) use both Maltese and English to teach physics and students are happy with the language used in the classroom. Thus showing that teachers are sensitive to their students’ needs and that language is not a barrier in oral communication in the classroom.

When it comes to written communication, not all students are happy with the current situation i.e. using English text when learning physics and in examinations. In fact just under half the students taking part in this study (48.3%) preferred the examination paper to be in English. More than one third (35.2%) of the students would choose a bilingual paper if they had the choice. Only a small amount of students would opt for a paper in Maltese only. Students whose level of English is very weak would benefit from a Maltese version of the examination. However, the preparation of students for this type of examination would have to be different in that notes and texts used in the classroom would then have to be in Maltese. This might pose other problems in that some (technical) words are not commonly known or do not exist in the Maltese language. It could also be a disadvantage for those students who would want to further their studies at a higher level.

Even though quite a number of students stated that they preferred to have a bilingual paper, the results from this study showed that students do not benefit from having this type of paper. It would be a good idea though to allow students to answer in Maltese and English. In fact many of the students taking part in this study (71%) stated that they found difficulty in communicating their answer in physics examinations. They found physics examinations difficult, not because they did not understand the content involved but because they had difficulty with the language used. This could also be observed whilst marking the tests. In most cases one could see that the students knew the answers but could not express themselves in English.

(continued on page 7)
**Language Use in Physics Education at SEC Level**

(continued from page 6)

When one takes an overview of the analysis of the results of the tests, it seems that students did best in the modified version. However this difference was not statistically significant. When the results according to gender were analysed, it was found that boys did best in the modified version of the test. However, surprisingly they did better in the original version than in the bilingual version of the test. This also supports the conclusion that a bilingual paper would not make a difference in the grades obtained in the examination. On the other hand girls did best in the modified version; they also performed better in the bilingual version than in the original version for most of the questions.

An interview was conducted with a number of students who participated in this study about the test they had done. The students were probed further on questions they got wrong. In most cases, it was observed that the students had difficulty in understanding the language of the question and so it was rephrased in Maltese. Most of the students gave correct verbal responses to the questions they had got wrong in the test. This shows that when a question is asked orally in Maltese by the teacher, the student understands the question better. However this cannot be done in examinations as obviously it is not feasible or practical. During the interview many students also remarked that they would like to have the opportunity to answer examination questions in Maltese and English. This is a suggestion which could easily be accomplished as most of the examiners of the SEC physics examination are Maltese. Students should be allowed to write some words in Maltese if they do not know the equivalent in English since here one is testing content not language.

A bilingual paper does not necessarily help students perform better. When preparing examination questions or text to use with students who have low proficiency in English, one should choose words which are easier to read and include clear diagrams related to the text. On the other hand, technical words in physics are inevitable and cannot be replaced by simpler words or phrases as this might make the text inexact or inaccurate.

**Chemistry Tuition without Practical Work is like swimming without water!**

(continued from page 2)

This is a multi-use experiment. It can be used when discussing fuels as sufficient vapour condenses on the inside to be poured out and tested afterwards with anhydrous cobalt chloride paper or anhydrous copper sulfate to show the presence of water. Swirling the insides with calcium hydroxide solution (limewater) will detect the presence of carbon dioxide. It can be use in energy change experiments and as a comparison with an alcohol/air fuel cell. A couple of tips might be worth sharing. The first is to angle the wooden spill into the neck of the bottle when igniting the vapour. Attempting to put the spill vertically into the tube will result in very burnt fingers! Second, do not attempt to dry the polycarbonate water bottle with acetone as the plastic will cloud over and may dissolve rendering the bottle useless. Third, always have two such bottles on hand as the students will always want to see it a second time.

**Iodine Clock Experiment**

This is both a fun experiment and one that can be used to teach kinetics. In the fun experiment students are told to mix 10 mL of Solution A and Solution B together and time how long it takes until a change occurs. The change is a sudden formation of a blue-black coloration from a colourless mixture. The students are asked then to work out by trial and error how much water should be added to 10mL aliquots of Solution A to make the colour change at exactly 60 seconds (or other target time) when reacted with 10mL of Solution B. See website below.

Teachers wishing to increase their knowledge of practical work that they could do with their students should investigate the Royal Society of Chemistry’s website [http://www.practicalchemistry.org/experiments/](http://www.practicalchemistry.org/experiments/). The large list of practicals is divided by age group. All health and safety, equipment lists and chemicals required are recorded and all experiments have been tried and tested by CLEAPPS. Have fun!
European Union Sustainable Energy Week

St. Francis Girls School Sliema and St. Ignatius College Boys’ Secondary School Tal-Handaq, in collaboration with the Malta Energy Efficiency and Renewable Energies Association have managed to coordinate a number of common activities in order to promote and encourage a more sustainable energy lifestyle. The two school communities also managed to participate in the EU Sustainable Energy Week. More details can be found at:

http://www.eusew.eu/energy-days-europe

Schools wishing to join this initiative next year are encouraged to contact the organisers to get more details about the event.

CONGRATULATIONS! We would like to congratulate the following Physics teachers who have recently been promoted: Mr Steve Mifsud, (Giovanni Curmi Higher Secondary) has been appointed Assistant Head of School at St. George Preca College BJL Hamrun; Mr Michel Spagnol (St Ignatius College, BSS) has been appointed Education Officer (Summative Assessment) and Mr Mario Azzopardi (Giovanni Curmi Higher Secondary School) has been appointed Head of Department (Physics). We wish them all the best in these new positions.

A new local Physics website has been launched….

http://physics.skola.edu.mt

Visit this website for the latest information about local science events, digital Physics resources, links to local & international science education websites and much more.

Special thanks to the webmasters:
Mr Stephen Bezzina (St Gorg Preca College BJL, Hamrun) & Mr Joseph Cutajar (Gozo BSS)

This newsletter is formulated by the Maltese Association of Science Educators in collaboration with the Curriculum Management and eLearning Department.

We would appreciate feedback from science educators about this newsletter, its content and presentation.

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